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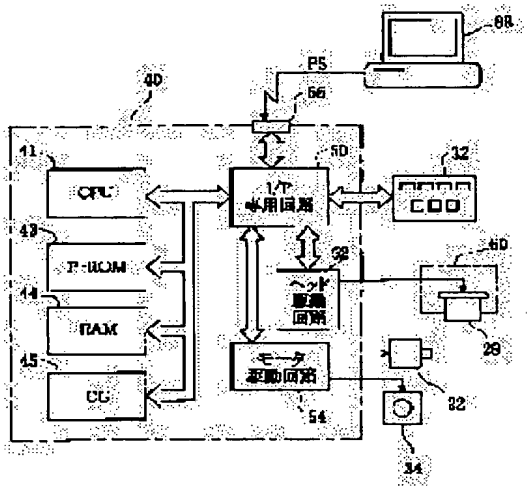
(54) ADJUSTMENT FOR RECORDING POSITION SHIFT AT BIDIRECTIONAL PRINTING WITH CORRECTION VALUE CHANGED BETWEEN MONOCHROMATIC PRINTING AND COLOR PRINTING

(57)Abstract:
PROBLEM TO BE SOLVED: To ease a recording position shift in a main scanning direction of ink drops between a first half and a second half of bidirectional printing and improve an image quality by using a first correction value in a monochromic printing mode and a second correction value in a color printing mode.
SOLUTION: A relative correction value for correcting a positional deviation in relation to the other nozzle array based on a black nozzle array is set. The positional shift when color bidirectional printing is carried out is corrected in accordance with the set value and a reference correction value. A control circuit 40 of a printer substitutes the reference correction value for an adjustment value when a computer 88 designates monochromic printing, or substitutes a sum of the reference correction value and the relative correction value for the adjustment value when the computer designates color printing, and supplies a signal for indicating a recording timing of a printing head 28 to a head-driving circuit 52. In executing color printing, an average value of shift values of cyan and magenta or a double value is used as the relative correction value.



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CLAIMS

[Claim(s)]
[Claim 1] The printer which prints on print media, performing both ways horizontal scanning characterized by providing the following bidirectionally The print head which has a nozzle group for recording a dot on print media by carrying out the regurgitation of the ink drop The horizontal-scanning mechanical component which performs bidirectional horizontal scanning by moving at least one side of the aforementioned print media and the aforementioned print head The vertical-scanning mechanical component which performs vertical scanning by moving at least one side of the aforementioned print media and the aforementioned print head The aforementioned print head is two or more single chromatic color nozzle groups which carry out the regurgitation of the ink drop of Isshiki of two or more chromatic colors to the colorless nozzle group which carries out the regurgitation of the ink drop with predetermined [have the head mechanical component which you give / mechanical component / a driving signal to the aforementioned print head, and makes it print on the aforementioned print media, and the control section which performs bidirectional print control, and colorless], respectively.
[Claim 2] It is the bidirectional printer set that it is a printer according to claim 1, and the 2nd correction value of the above reduces gap of the record position of the main scanning direction in the outward trip and return trip of an ink drop predetermined [of the ink drops in which the aforementioned single chromatic color nozzle group carries out the regurgitation] of an object color.
[Claim 3] It is the bidirectional printer set that it is a printer according to claim 2, and two or more aforementioned single chromatic color nozzle groups reduce gap of the record position of main scanning direction [in / the outward trip and return trip of the ink drop of the aforementioned cyanogen and the ink drop of the aforementioned Magenta / in the 2nd correction value of the above] including the cyano nozzle group which carries out the regurgitation of the ink drop of cyanogen, and the Magenta nozzle group which carries out the regurgitation of the ink drop of a Magenta.
[Claim 4] It is the bidirectional printer set that it is a printer according to claim 2, and two or more aforementioned single chromatic color nozzle groups reduce gap of the record position of main scanning direction [in / the outward trip and return trip of the ink drop of the aforementioned light cyanogen and the ink drop of the aforementioned light Magenta / in the 2nd correction value of the above] including the light cyanogen nozzle group which carries out the regurgitation of the ink drop of light cyanogen, and the light Magenta nozzle group which carries out the regurgitation of the ink drop of a light Magenta
[Claim 5] It is a printer according to claim 1. the 1st correction value of the above The aforementioned colorless nozzle group is determined according to the amendment information which shows the desirable amendment state chosen from the 1st position gap checking patterns formed on print media. the 2nd correction value of the above The bidirectional printer determined by the aforementioned color nozzle group according to the amendment information which shows the desirable amendment state chosen from the 2nd position gap checking patterns formed on print media at least.
[Claim 6] The printer according to claim 5 characterized by providing the following Two or more

aforementioned single chromatic color nozzle groups are cyano nozzle groups which carry out the regurgitation of the ink drop of cyanogen. The Magenta nozzle group which carries out the regurgitation of the ink drop of a Magenta ****** and the position gap checking pattern of the above 2nd are the 2nd outward trip pattern formed on the outward trip of horizontal scanning by one side of the aforementioned cyanogen nozzle group and the aforementioned Magenta nozzle group. The 2nd return trip pattern formed by the return trip of horizontal scanning on another side of the aforementioned cyanogen nozzle group and the aforementioned Magenta nozzle group

[Claim 7] the bidirectional printer which is a printer according to claim 1, and it is an execute permission about horizontal scanning at two or more horizontal-scanning speed, two or more aforementioned horizontal-scanning speed boils the 2nd correction value of the above, respectively, and the aforementioned printer receives, and is set up independently
[Claim 8] the bidirectional printer which is a printer according to claim 1, and it is an execute permission about horizontal scanning at two or more horizontal-scanning speed, two or more aforementioned horizontal-scanning speed boils the 1st correction value of the above, respectively, and the aforementioned printer receives, and is set up independently
[Claim 9] the bidirectional printer which it is a printer according to claim 1, the aforementioned printer can carry out the regurgitation of the ink in two or more dot regurgitation modes in which ink regurgitation speed differs mutually, and two or more aforementioned dot regurgitation modes boil the 2nd correction value of the above, respectively, receives, and is set up independently
[Claim 10] the bidirectional printer which it is a printer according to claim 1, the aforementioned printer can carry out the regurgitation of the ink in two or more dot regurgitation modes in which ink regurgitation speed differs mutually, and two or more aforementioned dot regurgitation modes boil the 1st correction value of the above, respectively, receives, and is set up independently
[Claim 11] It is the bidirectional printer to which it is a printer according to claim 1, and the 2nd correction value of the above is applied in common to the aforementioned color nozzle group.
[Claim 12] The 2nd correction value of the above is a bidirectional printer applied [in / the aforementioned color print mode / also use / in / the aforementioned color print mode / are a printer according to claim 11 and] the ink drop of the aforementioned achromatic color, and] in common to the aforementioned color nozzle group and the aforementioned colorless nozzle group.
[Claim 13] It is the bidirectional printer to which it is a printer according to claim 1, and the 2nd correction value of the above is independently set for every aforementioned single chromatic color nozzle group.
[Claim 14] It is the bidirectional printer which it is a printer according to claim 1, and the 2nd correction value of the above receives for every group of the aforementioned single chromatic color nozzle group which carries out the regurgitation of the ink of the same color, and is set up independently.
[Claim 15] The bidirectional printer which is a printer according to claim 1 and is further equipped with the non-volatile memory which stores the 1st correction value and the 2nd correction value.
[Claim 16] It is the bidirectional printer currently fixed to the aforementioned print head so that it may be a printer according to claim 15 and the aforementioned non-volatile memory may be detached and attached by the aforementioned printer with the aforementioned print head.
[Claim 17] The printer equipped with the print head which has a nozzle group for recording a dot on print media by carrying out the regurgitation of the ink drop is used. In the monochrome print mode which is the bidirectional printing method which prints on the aforementioned print media, performing horizontal scanning bidirectionally both ways, and uses only the ink drop of the aforementioned achromatic color In the color print mode which amends gap of the record position of the main scanning direction of the aforementioned ink drop in an outward trip and a return trip using the 1st correction value, and uses the ink drop of the aforementioned chromatic color at least gap of the record position of the main scanning direction of the aforementioned ink drop [in / an outward trip and a return trip / using the 2nd correction value] -- an amendment -- the bidirectional printing method characterized by things

[Claim 18] To a computer equipped with the printer equipped with the print head which has a nozzle group for recording a dot on print media by carrying out the regurgitation of the ink drop It is the record medium which recorded the computer program for making it print on the aforementioned print media, performing horizontal scanning bidirectionally both ways and in which computer reading is possible. In the monochrome print mode which uses only the ink drop of the aforementioned achromatic color In the color print mode which amends gap of the record position of the main scanning direction of the aforementioned ink drop in an outward trip and a return trip using the 1st correction value, and uses the ink drop of the aforementioned chromatic color at least The record medium which recorded the computer program for making the aforementioned computer realize an amendment function for gap of the record position of the main scanning direction of the aforementioned ink drop in an outward trip and a return trip using the 2nd correction value and in which computer reading is possible.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[The technical field to which invention belongs] Record position gap of an outward trip and a return trip is especially related with amendment technology about the technology which prints a picture on print media, this invention performing horizontal scanning bidirectionally both ways.
[0002]
[Description of the Prior Art] In recent years, the color printer of the type which carries out the regurgitation of the ink of **** from a head has spread widely as an output unit of a computer. There are some color printers which have the function to perform the so-called "bidirectional printing" for improvement in a print speed.
[0003]
[Problem(s) to be Solved by the Invention] In bidirectional printing, it originates in the backlash of the drive of main scanning direction, the curvature of the platen which supports print media in the bottom, etc., and is easy to produce the problem that the record position of the main scanning direction in an outward trip and a return trip will shift. What was indicated as technology which solves such position gap by JP,5-69625,A indicated by these people, for example is known. With this conventional technology, the amount of position gaps in main scanning direction (printing gap) was registered beforehand, and the record position in an outward trip and a return trip is amended based on this amount of position gaps.
[0004] However, there was a problem that position gap of other ink might not be amended and the quality of image of a color picture seldom improved by amendment of position gap in this case even if it amends position gap about one specific ink in two or more ink used in color printing. Such a problem especially had the serious influence on the quality of image by position gap in the big halftone field.
[0005] Moreover, what is necessary is just to amend record position gap optimal only about the ink used for monochrome printing, when carrying out monochrome printing by the same printer on the other hand, although it is necessary to amend record position gap taken into consideration about the ink of each color when performing color printing. And the way optimal about the ink used for monochrome printing of carrying out amendment differs from how to carry out amendment in consideration of the ink of each color used for color printing in many cases.
[0006] In case this invention is made in order to solve the above-mentioned technical problem in the conventional technology, and it performs bidirectional printing, it eases gap of the record position of the main scanning direction in an outward trip and a return trip, and aims at raising quality of image.
[0007]
[A The means for solving a technical problem, and its operation and effect] In order to solve a part of above-mentioned technical problem [at least], in case it prints on print media, ****** which breathes out an ink drop performing horizontal scanning bidirectionally both ways using the printer equipped with the print head which has a nozzle group for recording a dot on print media, the following processings are performed by this invention. That is, in the monochrome print mode which uses only a colorless ink drop, gap of the record position of the main scanning direction of the ink drop in an outward trip and a return trip is amended using the 1st correction value. And in the color print mode which uses the ink drop of a chromatic color at least, gap of the record position of the main scanning direction of the ink drop in an outward trip and a return trip is amended using the 2nd correction value.
[0008] If it does in this way, when the ink of a colorless nozzle group will perform monochrome printing, a record position can be amended using the 1st correction value suitable for monochrome printing, and in case color printing is performed, on the other hand, gap of a record position can be amended using the 2nd correction value suitable for color printing.
[0009] In addition, as for the 2nd correction value, it is desirable to determine that gap of the record position of the main scanning direction in the outward trip and return trip of an ink drop predetermined [of the ink drops in which a single chromatic color nozzle group carries out the regurgitation] of an object color is reduced. Alternatively in consideration of the high ink drop of the need of taking into consideration, the 2nd correction value can be defined suitably, without being dragged by how depending on which the low of the need of taking into consideration, or an ink color with it better [not to take into consideration] shifts if it does in this way.
[0010] Moreover, when two or more single chromatic color nozzle groups contain the cyano nozzle group which carries out the regurgitation of the ink drop of cyanogen, and the Magenta nozzle group which carries out the regurgitation of the ink drop of a Magenta, it can be determined that the 2nd correction value reduces gap of the record position of the main scanning direction in the outward trip and return trip of the ink drop of cyanogen and the ink drop of a Magenta. Compared with the color of others [Magenta / cyanogen and], record position gap of a dot tends to be conspicuous. Therefore, in this way, about cyanogen and the ink drop of a Magenta, if it determines that the 2nd correction value reduces gap of a record position, in color printing, the quality of image of a printing result can be raised as a whole.
[0011] And when two or more single chromatic color nozzle groups contain the light cyanogen nozzle group which carries out the regurgitation of the ink drop of light cyanogen, and the light Magenta nozzle group which carries out the regurgitation of the ink drop of a light Magenta, it can be determined that the 2nd correction value reduces gap of the record position of the main scanning direction in the outward trip and return trip of the ink drop of light cyanogen and the ink drop of a light Magenta. Light cyanogen and a light Magenta are ink used in the halftone field of a color picture. [most] And it has the influence in quality of image with a big precision of the record position of the dot of these ink. Therefore, if it determines that the 2nd correction value will make small record position gap of light cyanogen and a light Magenta, it is possible to raise the quality of image of a color picture.
[0012] In addition, a colorless nozzle group determines the 1st correction value according to the amendment information which shows the desirable amendment state chosen from the 1st position gap checking patterns formed on print media. As for the 2nd correction value, it is desirable to determine according to the amendment information which shows the desirable amendment state chosen from the 2nd position gap checking patterns formed on print media by the color nozzle group at least.
[0013] ** useless ****** can do the 1st correction value so that position gap of the main scanning direction in the outward trip and return trip of the colorless ink can be actually reduced appropriately based on such a mode, then the pattern formed on print media by the colorless nozzle group. And ** useless ****** is made so that the 2nd correction value can reduce appropriately position gap of the main scanning direction in the outward trip and return trip of color ink similarly based on the pattern formed on print media by the color nozzle group actually.
[0014] moreover, when two or more single chromatic color nozzle groups contain the cyano nozzle group which carries out the regurgitation of the ink drop of cyanogen, and the Magenta nozzle group which carries out the regurgitation of the ink drop of a Magenta As for the 2nd position gap checking pattern, it is desirable that the 2nd outward trip pattern formed by one side of a cyano nozzle group and a Magenta nozzle group on the outward trip of horizontal scanning and the 2nd return trip pattern formed on another side of a cyano nozzle group and a Magenta nozzle group by the return trip of horizontal scanning are included.
[0015] Usually, if it is going to define the correction value which both makes small record

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position gap of both a cyano ink drop and a Magenta ink drop based on a position gap checking pattern, it is necessary to print the position gap checking pattern of an outward trip and a return trip about a cyano ink drop and each Magenta ink drop. And it is necessary to calculate the optimal correction value for each ink drop based on it, and to complete the procedure of finally defining final correction value based on two correction value. However, an outward trip and a return trip can print the above modes, then 1 set of position gap checking pattern, and the correction value in consideration of record position gap of both a cyano ink drop and a Magenta ink drop can be defined only by defining correction value based on it. That is, it is not necessary to print a position gap checking pattern in both an outward trip and a return trip about a cyano ink drop and each Magenta ink drop.

[0016] in addition, it is desirable for two or more horizontal-scanning speed to boil the 2nd correction value at the horizontal-scanning speed of plurality [printer], respectively, in being an execute permission about horizontal scanning, and to receive, and to be set up independently and it is desirable for two or more horizontal-scanning speed to be alike, respectively, and to receive and to be similarly, set up independently about the 1st correction value Since it depends for the amount of gaps of a record position on horizontal-scanning speed, gap of a record position can be more effectively reduced by applying an independent value for every horizontal-scanning speed about the 1st correction value and the 2nd correction value.

[0017] Moreover, when a printer is able to carry out the regurgitation of the ink in two or more dot regurgitation modes in which ink regurgitation speed differs mutually, as for the 2nd correction value, it is desirable that an independent value is set up to each in two or more dot regurgitation modes. And it is desirable similarly that an independent value is set up to each in two or more dot regurgitation modes also about the 1st correction value. Since it depends for the amount of gaps of a record position also on ink regurgitation speed, gap of a record position can be more effectively mitigated by applying an independent value for every ink regurgitation speed about the 1st correction value and the 2nd correction value.

[0018] In addition, the 2nd correction value may be made to be applied in common to a color nozzle group. Moreover, in a color print mode, when also using a colorless ink drop, in a color print mode, you may apply the 2nd correction value in common to a color nozzle group and a colorless nozzle group. If it is made such, it is not necessary to perform complicated processing.

[0019] Or you may make it the 2nd correction value set up an independent value for every single chromatic color nozzle group. If it carries out like this, it is possible to mitigate gap of a record position effectively by every single chromatic color nozzle group.

[0020] Moreover, as the 2nd correction value, it receives for every group of the single chromatic color nozzle group which carries out the regurgitation of the ink of the same color, and you may make it apply an independent value. Since it depends for the amount of gaps of a record position on the physical-properties value of ink, gap of a record position can be more effectively mitigated by applying a value with the 2nd independent correction value for every ink.

[0021] Moreover, let memory for storing the 1st correction value and the 2nd correction value be the non-volatile memory prepared in the printer.

[0022] And as for the non-volatile memory, it is desirable to be fixed to the print head so that it may be detached and attached by the printer with the print head. the 2nd correction value which was suitable for the print head when carrying out like this and exchanging the print heads -- using -- gap of a record position -- an amendment -- things are possible

[0023] In addition, this invention is realizable in various modes, such as a computer program for realizing the function of the printing method, a printer, its printing method, or a printer, a record medium which recorded the computer program, and a data signal embodied in the subcarrier including the computer program.

[0024]

[Embodiments of the Invention] Next, the gestalt of operation of this invention is explained in order of the following based on an example.

A. composition [of equipment]: -- generating [of the record position gap between B. nozzle trains]: -- C. 1st example (record position gap amendment ** by criteria correction-value and relative correction value): -- D. 2nd example (record position gap amendment ** by criteria correction-value and relative correction value): -- E. 3rd example (the record position gap amendment between dots by absolute correction value): -- an F. modification [0025] A. Composition of equipment : drawing 1 is the outline block diagram of the printing system equipped with the ink jet printer 20 as the 1st example of this invention. The vertical-scanning delivery mechanism in which this printer 20 conveys a print sheet P in the direction of vertical scanning by the ejection motor 22, The horizontal-scanning delivery mechanism in which carriage 30 is made to reciprocate to the shaft orientations (main scanning direction) of a platen 26 by the carriage motor 24, The head drive which drives the print head unit 60 (it is called the "print head aggregate") carried in carriage 30, and controls the regurgitation of ink, and dot formation, It has the control circuit 40 which manages an exchange of a signal with these ejection motors 22, the carriage motor 24, the print head unit 60, and a control panel 32. The control circuit 40 is connected to the computer 88 through the connector 56.

[0026] The vertical-scanning delivery mechanism in which a print sheet P is conveyed is equipped with the gear train which transmits rotation of the ejection motor 22 to a platen 26 and a form conveyance roller (not shown) (illustration ellipsis). Moreover, the horizontal-scanning delivery mechanism in which carriage 30 is made to reciprocate is equipped with the pulley 38 which stretches the endless driving belt 36, and the position sensor 39 which detects the home position of carriage 30 between the sliding shaft 34 which is constructed in parallel with the shaft of a platen 26, and holds carriage 30 possible [sliding], and the carriage motor 24.

[0027] Drawing 2 is the block diagram showing the composition of the printer 20 centering on a control circuit 40. a control circuit -- 40 -- CPU -- 41 -- a programmable ROM (PROM) -- 43 -- RAM -- 44 -- a character -- a dot matrix -- having memorized -- a character generator -- (-- CG --) -- 45 -- having had -- arithmetic -- a logic operation circuit -- ****** -- constituting -- having -- **** . This control circuit 40 is further equipped with the I/F personal circuit 50 which performs an interface with an external motor etc. to exclusive use, the head drive circuit 52 which it connects [circuit] with this I/F personal circuit 50, and the print head unit 60 is driven [circuit], and makes ink breathe out, and the motorised circuit 54 which drives the ejection motor 22 and the carriage motor 24. The I/F personal circuit 50 builds in the parallel interface circuit, and can receive the printing signal PS supplied from a computer 88 through a connector 56.

[0028] Drawing 3 is explanatory drawing showing the regurgitation principle of ink with the concrete composition of the print head unit 60. As shown in drawing 3 , the print head unit 60 is carrying out the abbreviation configuration for L characters, and is equipped with the dashboard. 31 divided loading of the cartridge for black ink and the cartridge for color ink which are not illustrated is possible, and possible [wearing of both cartridges].

[0029] The head ID seal 100 in which the head identification information (it is called "Head ID") beforehand assigned according to the property of the print head unit 60 is shown is stuck on the upper-limit side of the print head unit 60. About the content of the head ID displayed on this head ID seal 100, it mentions later.

[0030] In addition, the whole composition of drawing 3 containing the print head 28 and the loading section of an ink cartridge is called "print head unit 60" because this print head unit 60 is detached and attached by the printer 20 as one part. That is, in case it is going to exchange the print head 28, the print head unit 60 will be exchanged.

[0031] The introductory pipes 71-76 which lead the ink from an ink container to the print head 28 are set up by the pars basilaris ossis occipitalis of the print head unit 60. the connection prepared in each cartridge when the print head unit 60 was equipped with the cartridge for black ink, and the cartridge for color ink from the upper part -- the introductory pipes 71-76 are inserted in a hole

[0032] Drawing 4 is explanatory drawing explaining the mechanism in which ink is breathed out. If the print head unit 60 is equipped with the cartridge for ink, the ink in the cartridge for ink will be sucked out through the introductory pipes 71-76, and as shown in drawing 4 , it will be led to the print head 28 prepared in the print head unit 60 lower part.

[0033] The print head 28 has the actuator circuit 90 which operates piezo-electric element PE prepared in two or more nozzles n prepared in the single tier for every color, and each nozzle n.

The actuator circuit 90 is a part of head drive circuit 52 (drawing 2), and carries out ON/OFF control of the driving signal given from the driving-signal generation circuit which is not illustrated in the head drive circuit 52. That is, the actuator circuit 90 latches the data in which ON (the regurgitation of the ink is carried out) or OFF (ink is breathed out and there is nothing) is shown about each nozzle according to the printing signal PS supplied from the computer 88, and impresses a driving signal to piezo-electric element PE only about the nozzle of ON.

[0034] Drawing 5 is explanatory drawing showing the drive principle of the nozzle n by piezo-electric element PE. Piezo-electric element PE is installed in the position adjacent to the ink path 80 to which ink is led to Nozzle n. Piezo-electric element PE develops quickly and makes the unilateral wall of the ink path 80 transform in this example, by impressing the voltage of predetermined-time width of face to inter-electrode [which was prepared in the ends of piezo-electric element PE], as shown in drawing 5 (B). Consequently, it contracts according to extension of piezo-electric element PE, and the ink equivalent to a part for this contraction serves as Particle Ip, and the volume of the ink path 80 is breathed out by high speed from the nose of cam of Nozzle n. Printing will be performed when this ink particle Ip sinks into the form P with which the platen 26 was equipped.

[0035] Drawing 6 is explanatory drawing showing the correspondence relation between the nozzle of two or more trains prepared in the print head 28, and two or more actuator chips. This printer 20 is a printer which prints using the ink of black (K), dark cyanogen (C), light cyanogen (LC), a dark Magenta (M), a light Magenta (LC), and six colors of yellow (Y), and is equipped with the nozzle train for each ink, respectively. In addition, dark cyanogen and light cyanogen are cyano ink in which it has the almost same hue and concentration differs. The same is said of dark Magenta ink and light Magenta ink.

[0036] The 1st actuator chip 91 which drives the black nozzle train K and the dark cyanogen nozzle train C, the 2nd actuator chip 92 which drives the light cyanogen nozzle train LC and the dark Magenta nozzle train M, and the 3rd actuator chip 93 which drives the light Magenta nozzle train LM and the yellow nozzle train Y are formed in the actuator circuit 90.

[0037] Drawing 7 is the decomposition perspective diagram of the actuator circuit 90. Three actuator chips 91-93 are pasted up with adhesives on the layered product of a nozzle plate 110 and the reservoir plate 112. Moreover, the end-connection child plate 120 is fixed after the actuator chips 91-93. The external end-connection child 124 for electrical installation with an external circuit (specifically I/F personal circuit 50 of drawing 2) is formed in the end of the end-connection child plate 120. Moreover, the internal connection terminal 122 for electrical installation with the actuator chips 91-93 is formed in the inferior surface of tongue of the end-connection child plate 120. Furthermore, the driver IC 126 is formed on the end-connection child plate 120. In the driver IC 126, the circuit which latches the printing signal given from the computer 88, the analog switch which embraces the printing signal, and turns on / turns off a driving signal are prepared. In addition, as for the wiring between a driver IC 126 and the end-connection child 122,124, illustration is omitted.

[0038] Drawing 8 is the fragmentary sectional view of the actuator circuit 90. Here, although only the cross section of the end-connection child plate 120 of the upper part is indicated to be the 1st actuator chip 91, it has the structure as the 1st actuator chip 91 where other actuator chips 92 and 93 are the same.

[0039] The nozzle mouth for each ink is formed in the nozzle plate 110. The reservoir plate 112 is a plate for forming the stores dept. (reservoir) of ink. The actuator chip 91 has the ceramic sintered compact 130 which forms the ink path 80 (drawing 5), piezo-electric element PE arranged through a wall surface in the upper part, and the terminal electrode 132. If the end-connection child plate 120 is fixed after the actuator chip 91, the end-connection child 122 prepared in the inferior surface of tongue of the end-connection child plate 120 and the terminal electrode 132 prepared in the upper surface of the actuator chip 91 will be connected electrically. In addition, as for the wiring between the terminal electrode 132 and piezo-electric element PE, illustration is omitted.

[0040] B. Generating of the record position gap between nozzle trains : in the 1st, the 2nd, and 3rd examples mentioned later, the record position gap generated between nozzle trains is

adjusted at the time of bidirectional printing. Then, before explaining these examples, below, generating of gap of the record position between nozzle trains is explained first.

[0041] Drawing 9 is explanatory drawing showing the position gap at the time of bidirectional printing about a different nozzle train. Nozzle n is moving bidirectionally horizontally [above a print sheet P], and forms a dot on a print sheet P by carrying out the regurgitation of the ink in an outward trip and a return trip, respectively. Here, the case where black ink K is breathed out, and the case where cyano ink C is breathed out are illustrated in piles. It turns to a vertical lower part and black ink K is the regurgitation speed VK. Assuming that it is what is breathed out, on the other hand, cyano ink C is the low regurgitation speed VC from black ink. It is assumed that it is what is breathed out. The synthesis rate vector CVK of each ink, and CVC It becomes what compounded the regurgitation velocity vector to a lower part, and the horizontal-scanning velocity vector Vs of Nozzle n. With black ink K and cyano ink C, they are the regurgitation speed VK to a lower part, and VC. Since it differs, the synthesis rate CVK differs from the size and direction of CVC mutually.

[0042] In this example, about the black dot, it is amended so that position gap of bidirectional printing may become zero. However, synthesis rate vector CVC of cyano ink C Synthesis rate vector CVK of black ink K Since it differs, if the regurgitation of the cyano ink C is carried out to the same timing as black ink K, about the record position of a cyano dot, big gap will arise on a print sheet P. Moreover, it turns out that the relative physical relationship (relation on either side) of the black dot in an outward trip and a cyano dot has reversed the physical relationship in a return trip.

[0043] Drawing 10 is explanatory drawing showing superficially gap of the record position shown in drawing 9 . Here, the case where the vertical ruled line which met in the direction y of vertical scanning is recorded in an outward trip and a return trip using black ink K and cyano ink C, respectively is shown. The vertical ruled line recorded on the outward trip using black ink is in agreement with the vertical ruled line on which the position of main scanning direction x was recorded in the return trip. The vertical ruled line which the vertical ruled line recorded on the outward trip using cyano ink was recorded on the right of the vertical ruled line of black on the other hand, and was recorded in the return trip is recorded on the left of the vertical ruled line of black.

[0044] Thus, when gap of the record position of an outward trip and a return trip was amended only about a black nozzle train, there was a case where gap of a record position could not be well amended about other nozzle trains.

[0045] The regurgitation speed of the ink drop breathed out from each nozzle train changes depending on the following various factors.

(1) The manufacture error of an actuator chip.

(2) The physical property of ink (for example, viscosity).

(3) The weight of an ink drop.

[0046] When factors with a main regurgitation speed of an ink drop are the manufacture errors of an actuator chip, the regurgitation speed of the ink drop breathed out from the same actuator chip is almost the same. therefore, gap of a record position [in / main scanning direction / the whole group of the nozzle train driven with a different actuator chip in this case] -- an amendment -- things are desirable

[0047] gap of the record position of a dot [in / main scanning direction / every ink and the whole nozzle train / when the physical property of ink and the weight of an ink drop also have big influence on the regurgitation speed on the other hand] -- an amendment -- things are desirable

[0048] C. The 1st example (record position gap amendment ** by criteria correction value and relative correction value) : drawing 11 is a flow chart which shows the whole processing in the 1st example of this invention. At Step S1, a printer 20 is assembled in a production line, and relative correction value is set up by the operator in a printer 20 at Step S2. At Step S3, a printer 20 is shipped from works, and in step S4, the user who purchased the printer 20 sets up the criteria correction value of an amendment sake for the position gap at the time of use, and performs printing. Below, the content of Step S2 and S4 is explained to a detail, respectively.

[0049] Drawing 12 is a flow chart which shows the detailed procedure of Step S2 of drawing 10 . At Step S11, the test pattern for relative correction value determination (relative-position gap checking pattern) is printed using a printer 20. Drawing 13 is explanatory drawing showing an example of the test pattern for relative correction value determination. This test pattern is six vertical ruled lines LK, LC, and LLC extended in the direction y of vertical scanning on a print sheet P, LM, LLM, and LY. It is formed in the ink K, C, LC, M, LM, and Y of six colors, respectively. In addition, these six vertical ruled lines are recorded by making ink breathe out simultaneously from 6 sets of nozzle trains, scanning carriage 30 at a fixed speed. In addition, in the ink regurgitation in one horizontal scanning, since the dot which left only the nozzle pitch of the direction y of vertical scanning can only be formed, in order to record a vertical ruled line as shown in drawing 13 , the regurgitation of the ink is carried out to the same timing at the time of horizontal scanning of multiple times.
[0050] In addition, as a test pattern, it is also possible by the vertical ruled line to use a straight-line-like pattern with which there is nothing and the dot was recorded intermittently. This is the same also about the test pattern for criteria correction value determination mentioned later.
[0051] At Step S12 of drawing 12 , the mutual amount of gaps of six vertical ruled lines shown in drawing 13 is measured. This measurement reads the picture of a test pattern by the CCD camera, and is the vertical ruled lines LK, LC, and LLC, LM, LLM, and LY. It realizes by measuring the position of main scanning direction x by the image processing. Since the position of six vertical ruled lines is formed by carrying out the regurgitation of the ink simultaneously from 6 sets of nozzle trains, if the regurgitation speed of the ink by 6 sets of nozzle trains is the same, the interval of six vertical ruled lines must be equal to the interval of a nozzle train.
[0052] The x-coordinate value xC shown in drawing 13 , xLC, xM, xLM, and xY Vertical ruled line LK of black ink X-coordinate value xK When it considers as criteria, the coordinate value of each vertical ruled line in case other five vertical ruled lines are located in a line as the design value of the interval of a nozzle train is shown. Then, these x-coordinate values xC, xLC, xM, xLM, and xY Below, the position shown is called "design position." Amount of gaps deltaC with as actual about five vertical ruled lines other than the vertical ruled line of black at Step S12 a vertical ruled line position as a design position, deltaLC, deltaM, deltaLM, and deltaY It measures. At this time, when having shifted on the right of the design position, it shifts and considers as the value of plus of an amount delta, and when you have shifted on the left of the design position, it shifts and let an amount delta be the value of minus.
[0053] At Step S13, from the amount of gaps measured in this way, an operator determines the suitable head ID and the head ID is set up in a printer 20. This head ID is measured information which shifts and shows the suitable relative correction value of an amendment sake for an amount. As suitable relative correction value delta, it is the vertical ruled line LK which serves as criteria so that it may be given by the following (1) formulas, for example. Average deltaave of the amount of gaps of all other vertical ruled lines of an except What reversed the sign of positive/negative can be used.
delta=-deltaave =-sigmadeltai /(N-1) -- (1)
Here, sigma shows the operation which takes the sum of amount of gaps deltai of all vertical ruled lines other than the vertical ruled line of the black ink used as criteria, and N shows the total (namely, the number of nozzle trains) of a vertical ruled line.
[0054] Drawing 14 is explanatory drawing showing the relation between the relative correction value delta and Head ID. In this example, when delta is the relative correction value of -35.0 micrometers, whenever Head ID is set as 1 and the relative correction value delta increases 17.5 micrometers, one value of Head ID increases. Here, 17.5 micrometers is the minimum value (value which can be minimum adjusted) of the amount of gaps of the main scanning direction which can be adjusted in a printer 20. A value equal to the dot pitch in alignment with main scanning direction as this value that can be minimum adjusted can be used. For example, when the resolution of main scanning direction is 1440dpi, the dot pitch is about 17.5 micrometers (=25.4mm/1440), and this value is used as a value which can be minimum adjusted. In addition, it is also possible to make a value smaller than a dot pitch into the value which can be minimum adjusted.

[0055] In this way, the determined head ID is stored in PROM43 (drawing 2) in a printer 20. In this example, the head ID seal 100 in which Head ID is shown is further stuck on the upper surface of the print head unit 60 (drawing 3). Or non-volatile memory (for example, programmable ROM) is prepared in the driver IC 126 (drawing 7) prepared in the print head unit 60, and you may make it store Head ID in the non-volatile memory. If the head ID seal 100 is stuck on the print head unit 60 or Head ID is stored in the non-volatile memory in the print head unit 60, when using the print head unit 60 for other printers 20, there is an advantage that the head ID suitable for the print head unit 60 can be used.
[0056] In addition, in the process before including the print head unit 60 in a printer 20, determination of the relative correction value in Step S2 can also be performed, where the print head unit 60 is included in the test equipment of exclusive use. In this case, Head ID is registered into PROM43 in a printer 20, in case it sets like a subsequent printer assembler and the print head unit 60 is included in a printer 20. As the method of registration into PROM43, the method of reading with the reader of exclusive use of the head ID seal 100 and how an operator inputs Head ID from a keyboard are employable, for example. Or you may make it transmit the head ID stored in the non-volatile memory in the print head unit 60 to PROM43 in a printer 20.
[0057] In addition, the relative correction value delta is good also as the average of the amount of gaps of light cyanogen and a light Magenta so that it may be given by the following (2) formulas.
delta=- (delta LC+delta LM)/2 -- (2)
[0058] Light cyanogen and a light Magenta are ink used in the halftone field (range whose picture concentration of cyanogen or a Magenta is about 10% - about 30% especially) of a color picture, and the precision of the record position of the dot of these ink has big influence in quality of image. [most] Therefore, if Head ID is determined from the average of the amount of gaps of light cyanogen and a light Magenta, since these amounts of position gaps can be reduced, it is possible to raise the quality of image of a color picture.
[0059] In addition, only about light cyanogen ink and light Magenta ink, when using the above-mentioned (2) formula, if the amount delta of gaps from black ink is measured, it is enough.
[0060] A printer 20 is shipped, after Head ID is set up in a printer 20, as shown in the flow chart of drawing 11 . In case a user uses a printer 20, gap of the record position at the time of bidirectional printing is adjusted as follows using this head ID.
[0061] Drawing 15 is a flow chart which shows the procedure of the gap adjustment at the time of a user's use. At Step S21, the test pattern for criteria correction value determination (criteria position gap checking pattern) is printed using a printer 20. Drawing 16 is explanatory drawing showing an example of the test pattern for criteria correction value determination. This test pattern consists of two or more vertical ruled lines printed in the outward trip and the return trip using black ink, respectively. Although the vertical ruled line is recorded at the fixed interval on the outward trip, the position of the main scanning direction of a vertical ruled line is shifted one by one per 1 dot pitch in the return trip. Consequently, on a print sheet P, two or more sets of vertical ruled line pairs from which one dot pitch of relative positions of the vertical ruled line of an outward trip and the vertical ruled line of a return trip shifts at a time are printed. The number of a gap adjustment number is printed under two or more sets of vertical ruled line pairs. A gap adjustment number has the function as amendment information which shows a desirable amendment state. Here, "a desirable amendment state" means the state where the position of the main scanning direction of the dot formed in the outward trip and the return trip, respectively is in agreement, when the record position (or record timing) in an outward trip or a return trip is amended with suitable criteria correction value. Therefore, a desirable amendment state is realized by suitable criteria correction value. In addition, in the example of drawing 16 , the vertical ruled line pair whose gap adjustment number is 4 shows the desirable amendment state.
[0062] In addition, the test pattern for criteria correction value determination is formed in the criteria nozzle train currently used on the occasion of the determination of relative correction value. Therefore, when a Magenta nozzle train is used as a criteria nozzle train instead of a black nozzle train on the occasion of the determination of relative correction value, the test pattern

for criteria correction value determination is also formed in the Magenta nozzle train.
[0063] A user observes this test pattern and inputs the gap adjustment number of a vertical ruled line pair with least gap into the user interface screen (not shown) of the printer driver of a computer 88 (drawing 2). This gap adjustment number is stored in PROM43 in a printer 20.
[0064] Then, if execution of printing is directed by the user in Step S23, bidirectional printing will be performed in Step S24, performing gap amendment using criteria correction value and relative correction value. Drawing 17 is the block diagram showing the main composition relevant to the gap amendment at the time of bidirectional printing in the 1st example. The head ID storing field 200, the adjustment number storing field 202, the relative correction value table 204, and the criteria correction value table 206 are formed in PROM43 in a printer 20. The head ID which shows desirable relative correction value is stored in the head ID storing field 200. The gap adjustment number which shows desirable criteria correction value is stored in the adjustment number storing field 202. The relative correction value tables 204 are the head ID shown in drawing 14 , and a table which stored the relation with the relative correction value delta. The criteria correction value table 206 is a table showing the relation of criteria correction value with a gap adjustment number. The criteria correction value table 206 is a table which shifted from the amount of gaps of the record position of the vertical ruled line of the return trip in the test pattern shown in drawing 16 (namely, criteria correction value), and stored the relation with an adjustment number.
[0065] The computer program which has a function as a position gap amendment statement part (record justification section) 210 of an amendment sake is stored in RAM44 in a printer 20 in the position gap at the time of bidirectional printing. The position gap amendment statement part 210 reads the criteria correction value corresponding to a gap adjustment number from the criteria correction value table 206 while reading the relative correction value corresponding to the head ID stored in PROM43 from the relative correction value table 204. The position gap amendment statement part 210 will supply the signal (amount set point of delay deltaT) for directing the record timing of a head to the head drive circuit 52 according to the synthetic correction value of relative correction value and criteria correction value, if the signal which shows the home position of carriage 30 from a position sensor 39 (drawing 1) in a return trip is received. The inside of the head drive circuit 52 supplies the same driving signal to three actuator chips 91-93, and adjusts the record position of a return trip according to the record timing (namely, amount set point of delay deltaT) given from the position gap amendment statement part 210. It is adjusted in the amount of amendments in which the record position of 6 sets of nozzle trains is common in a return trip with this. As mentioned above, since relative correction value and criteria correction value is both also set as the integral multiple of the dot pitch of main scanning direction, this record position (namely, record timing) is also adjusted in the unit of the dot pitch of main scanning direction. In addition, synthetic correction value is a value adding criteria correction value and relative correction value. Moreover, although the ruled line printed in a return trip here was formed so that one dot pitch might shift at a time, shifting the printing position of a ruled line in a finer unit, then correction value can also be set up by the integral multiple of the unit. Namely, if the serration of gap of the ruled line printed in a return trip is set up finely, correction value can be defined in the more delicate range. The minimum value of this serration is decided by the restrictions on control of a printer.
[0066] Drawing 18 is explanatory drawing showing the content of the position gap amendment which used criteria correction value and relative correction value. Drawing 18 (A) shows that it is printed by the position where the vertical ruled line formed by the black dot shifted in the outward trip and the return trip, when position gap is not being adjusted. Drawing 18 (B) shows the result which adjusted position gap of a black dot using criteria correction value. If amendment by criteria correction value is performed, about a black dot, position gap will be canceled at the time of bidirectional printing. Drawing 18 (C) shows the case where the vertical ruled line formed by the cyano dot other than the vertical ruled line formed by the black dot is also printed, in the same adjustment state as drawing 18 (B). Drawing 18 (C) is the same as drawing 10 , and although there is no position gap of a black dot, position gap of a cyano dot is quite large. In addition to the gap adjustment by criteria correction value, drawing 18 (D) shows

the ruled line of the black dot at the time of also performing gap adjustment by the relative correction value delta about a cyano dot (=-deltaC), and the ruled line of a cyano dot. In drawing 18 (D), although position gap of a cyano dot is mitigated, position gap of a black dot is increasing a little, consequently position gap of a black dot and a cyano dot is decreasing almost to the same extent. This reason is that it has amended the record position of 6 sets of nozzle trains in a return trip in the common amount of amendments. The example of drawing 18 (D) is an example to which two kinds of dots of a black dot and a cyano dot were chosen as as an object dot of position gap adjustment, and position gap adjustment about two kinds of these dots was carried out.
[0067] Drawing 19 is explanatory drawing showing the content of the position gap amendment when setting only a cyano dot as the object of position gap adjustment. The adjustment by the criteria correction value shown in drawing 19 (A) - drawing 19 (C) is the same as drawing 18 (A) - drawing 18 (C), and drawing 19 (D) differs from drawing 18 (D). Amount of gaps deltaC of a cyano dot [in / the test pattern for relative correction value determination (drawing 13) / as relative correction value delta / at drawing 19 (D)] The value (value which gave the minus sign to it correctly) of double precision is used. If it carries out like this, although position gap of a black dot will become large, a cyano dot can set position gap of a round trip to about 0.
[0068] When amount of gaps delta of the specific dot in the test pattern for relative correction value determination itself is used as relative correction value delta so that he can understand from the example of drawing 18 and drawing 19 , the both sides of the specific dot and criteria dot (black dot) can be equivalent to the object dot of position gap adjustment, and can decrease the position gap about these object dots. On the other hand, when the double precision of the amount delta of gaps of the specific dot in the test pattern for relative correction value determination is used as relative correction value delta, only the specific dot can be equivalent to the object dot of position gap adjustment, and can reduce the position gap about the object dot. When the relative correction value delta (=- (delta LC+delta LM)/2) specifically given by (2) formulas mentioned above is used, the position gap about three kinds of dots of **, a black dot, a light cyanogen dot, and a light Magenta dot can be reduced almost to the same extent. Moreover, when the value of the double precision is used as relative correction value, the position gap about two kinds of dots, a light cyanogen dot and a light Magenta dot, can be reduced almost to the same extent. When the relative correction value delta (=-deltaave) which similarly is given by (1) formula mentioned above is used, the position gap about six kinds of all dots can be reduced almost to the same extent. Moreover, when the value of the double precision is used as relative correction value, the position gap about five kinds of dots other than a black dot can be reduced almost to the same extent.
[0069] In addition, since a bird clapper will be greatly prevented for position gap of the dot of color ink too much if position gap adjustment is performed based on criteria correction value and relative correction value so that drawing 18 (D) and drawing 19 (D) may show, the quality of image of a color picture improves.
[0070] In addition, since color ink is not used in monochrome printing, there is no need of performing position gap amendment using relative correction value like drawing 18 (D) and drawing 19 (D). Therefore, in monochrome printing, the position gap amendment only using criteria correction value is more desirable like drawing 18 (B). then -- the time of the control circuit 40 (specifically position gap amendment statement part 210 of drawing 17) of a printer 20 amending the position gap at the time of bidirectional printing only using criteria correction value, when it is notified from a computer 88 (drawing 1) that it is monochrome printing, and it being notified that it is color printing -- criteria correction value and relative correction value -- using -- the position gap at the time of bidirectional printing -- an amendment -- constituting like is desirable
[0071] Drawing 22 is a flow chart which shows the procedure of the processing at the time of determining the adjustment value used for amendment of the position gap at the time of bidirectional printing. When the purport which is monochrome printing is notified from a computer 88 (drawing 1), the control circuit 40 of a printer 20 substitutes criteria correction value for an adjustment value, and supplies the signal for directing the record timing of a head to the head

drive circuit 52. On the other hand, when the purport which is color printing is notified from a computer 88 (drawing 1), the control circuit 40 of a printer 20 substitutes the sum of criteria correction value and relative correction value for an adjustment value, and supplies the signal for directing the record timing of a head to the head drive circuit 52. That is, in the 1st example, criteria correction value is equivalent to "the 1st correction value", and relative correction value is equivalent to "the 2nd correction value."

[0072] By the way, the case where he wants to exchange the print head unit 60 arises for the reasons of the long term deterioration of the print head unit 60 etc. When exchanging the print head unit 60, the head ID of the print head unit 60 after exchange is written in PROM43 in the control circuit 40 of a printer 20. There are some following methods as a method of performing the writing of this head ID. The 1st method is the method of a user inputting the head ID currently displayed on the head ID seal 100 stuck on the print head unit 60 from a computer 88, and writing in PROM43. The 2nd method is a method which a control circuit 40 reads Head ID and writes in PROM43 from the non-volatile memory prepared in the driver IC 126 (drawing 7) of the print head unit 60. thus, the head ID (namely, relative correction value) which was suitable for the print head unit 60 after exchange when the head ID was stored in PROM43 after exchange of the print head unit 60 -- using -- the position gap at the time of bidirectional printing -- an amendment -- things are possible

[0073] As mentioned above, in the 1st example, the relative correction value of an amendment sake was set up for the position gap at the time of bidirectional printing about other nozzle trains on the basis of the black nozzle train, and the position gap at the time of color bidirectional printing is amended according to this relative correction value and the criteria correction value about a black nozzle train. Consequently, it is possible to raise the quality of image of color printing. Especially a user has the advantage that the quality of image at the time of color bidirectional printing can be raised that what is necessary is to perform only adjustment of the position gap about a criteria nozzle train, without adjusting position gap of ink altogether.

[0074] Moreover, in the case of monochrome printing, the position gap at the time of bidirectional printing was amended only using criteria correction value, and position gap is amended using criteria correction value and relative correction value in the case of color printing. For this reason, there is an advantage that the quality of image of a printing result is high, about both monochrome printing and color printing.

[0075] Drawing 20 is explanatory drawing showing other composition of the nozzle train of the print head 28. 3 sets of nozzle trains K1-K3 of black (K) are formed in this print head 28a, and cyanogen (C), the Magenta (M), and the nozzle train of yellow (Y) are prepared in it 1 set, respectively. High-speed printing is performed in the case of monochrome printing, using 3 sets of black nozzle trains K1-K3 for all. On the other hand, in the case of color printing, 2 sets of black nozzle trains K1 and K2 of the 1st actuator chip 91 are not used, but 1 set of black nozzle trains K3 of the 2nd actuator chip 92, the cyano nozzle train C and the Magenta nozzle train M, the yellow nozzle train Y, and ** are used for it.

[0076] When performing color printing using such the print head, the average of the amount of gaps of cyanogen and a Magenta or the value of the double precision is used as relative correction value delta at the time of color bidirectional printing so that it may be given by the following (3a) and the formula (3b).

delta=- (deltaC+deltaM)/2 -- (3a)

delta=- (deltaC+deltaM) -- (3b)

[0077] In addition, amount of gaps deltaC of cyanogen and a Magenta and deltaM In the test pattern for relative correction value determination (drawing 13), it is the relative amount of gaps measured on the basis of the vertical ruled line formed in the black nozzle train K3 used in the case of color printing.

[0078] Thus, it is possible to raise the quality of image of a color picture by determining Head ID from the average of the amount of gaps of cyanogen and a Magenta in 4 color printing which does not use light ink. Here, yellow is excepted for there being no big influence in quality of image, even if the yellow dot was seldom conspicuous and the yellow dot has shifted somewhat at the time of bidirectional printing. However, you may make it determine Head ID from the

average of the amount of gaps of cyanogen, a Magenta, and yellow. That is, you may make it determine relative correction value in two or more nozzle trains used for color printing using the average of the amount of gaps about all other nozzle trains other than a criteria nozzle train.

[0079] In addition, you may ask for relative correction value deltaK of other black nozzle trains K1 and K2 to the black nozzle train K3 made into criteria. It can ask for this relative correction value deltaK according to the following (4) formulas.

deltaK=- (deltaK1+deltaK2)/2 -- (4)

Here, it is deltaK1. The amount of gaps about the 1st black nozzle train K1, and deltaK2 It is the amount of gaps about the 2nd black nozzle train K2.

[0080] If position gap amendment is carried out at the time of bidirectional printing using relative correction value deltaK about 2 sets of these black nozzle trains K1 and K2, and the criteria correction value (what was determined by drawing 15) about the black nozzle train K3 made into criteria in the case of monochrome printing, position gap of bidirectional printing in monochrome printing using 3 sets of nozzle trains can be reduced. namely, the criteria correction value about the criteria black nozzle train of pinpointing in it when two or more black nozzle trains are used in the case of monochrome printing and the relative correction value about other black nozzle trains -- using -- the position gap at the time of bidirectional printing -- an amendment -- it is desirable to make it like

[0081] D. The 2nd example (record position gap amendment ** by criteria correction value and relative correction value) : drawing 21 is the block diagram showing the main composition related to the gap amendment at the time of bidirectional printing in the 2nd example. The difference from composition of having been shown in drawing 17 is the point that the head drive circuits 52a, 52b, and 52c for driving three actuator chips 91, 92, and 93 are formed independently. That is, three head drive circuits 52a, 52b, and 52c drive three actuator chips 91, 92, and 93 independently. For this reason, directions of the record timing from the position gap amendment statement part 210 can also be independently given to each head drive circuits 52a, 52b, and 52c. Therefore, position gap amendment at the time of bidirectional printing can also be performed for every actuator chip.

[0082] Also in the 2nd example, the black nozzle train K of the 1st actuator chip 91 is used as a criteria nozzle train. Therefore, criteria correction value is determined from the test pattern recorded using the black nozzle train K like the 1st example.

[0083] On the other hand, relative correction value is determined for every actuator chip in the 2nd example. That is, it is amount of gaps deltaC of the vertical ruled line formed in the dark cyanogen nozzle train C so that it might be given by the following formulas (4a) as relative correction value delta 91 of the 1st actuator chip 91. The value which reversed the sign of positive/negative is adopted.

delta91=-deltaC -- (4a)

[0084] Moreover, the value which reversed the sign of the positive/negative of the average of the amount of gaps about the nozzle train of each actuator chip is adopted so that it may be given by the following formulas (4b) and (4c) formulas, respectively as relative correction value delta 92 and delta 93 of the 2nd and 3rd actuator chip 92 and 93.

delta92=- (deltaLC+deltaM)/2 -- (4b)

delta93=- (deltaLM+deltaY)/2 -- (4c)

[0085] In addition, the relative correction value delta 92 and delta 93 to the 2nd and 3rd actuator chip 92 and 93 may be determined from the amount of gaps of the record position from the criteria nozzle train about one nozzle train. At this time, the following (5b) and a formula (5c) can be used instead of the above (4b) and (4c).

delta92=-deltaLC -- (5b)

delta93=-deltaLM -- (5c)

[0086] The head ID showing such three relative correction value delta 91, delta 92, and delta 93 is stored in PROM43 in a printer 20. Moreover, according to this head ID, the relative correction value delta 91, delta 92, and delta 93 is supplied to the position gap amendment statement part 210. In addition, it is also possible to use the value of the double precision of the value of the right-hand side of these formulas as relative correction value instead of the above-mentioned

(4a) formula - (5c) a formula.
[0087] In the 2nd example mentioned above, the feature is in the point that relative correction value can be independently set up for every actuator chip. If it carries out like this, since the relative position gap from a criteria nozzle train can be amended for every actuator chip, the position gap at the time of bidirectional printing can be reduced more. In addition, by the printer of the type which drives 3 sets of nozzle trains with one actuator chip, relative correction value can be independently set up for 3 sets of every nozzle trains.
[0088] In addition, it is desirable to choose a light cyanogen dot and a light Magenta dot from the meaning which raises the quality of image of a halftone field as an object dot of position gap adjustment, and to decrease position gap of these dots. However, the principle of the above 1st and the 2nd example can be applied, when choosing specific ink with comparatively low concentration (namely, specific ink other than black) as an object dot of position gap adjustment among M kinds of ink and decreasing position gap of the object dot, in case color printing is performed using M kinds (M is two or more integers) of ink.
[0089] E. 3rd example (record position gap amendment between dots by absolute correction value): -- flow [of the whole (1) processing]: -- drawing 23 is a flow chart which shows the procedure of gap adjustment Although criteria correction value was defined about black (K) and the relative correction value on the basis of black (K) was defined about each of other color in the 1st and 2nd examples, the absolute correction value same about each (it takes into consideration in the case of amendment) color as the black (K) in the 1st example is defined in the 3rd example. Moreover, in the 3rd example, a user performs adjustment of a dot record position altogether in principle. That is, in this 3rd example, the method of the determination of an adjustment value differs from the 1st example. And for the reason, the composition of an adjustment number storing field and a correction value table and processing of a position gap amendment statement part differ from the 1st example. About other points, it is the same as that of the 1st example.
[0090] Drawing 24 is state **** explanatory drawing which printed the test pattern for correction value determination in the 3rd example. At Step S31 (drawing 23), the test pattern for correction value determination is printed using a printer 20. Here, the test pattern equivalent to the test pattern for the criteria correction value determination of the 1st example (drawing 16) is separately printed about the black nozzle train K, the light cyanogen nozzle train LC, and the light Magenta nozzle train LM. Consequently, as shown in drawing 24 , the test pattern printed in the outward trip and the return trip, respectively is formed on a print sheet P about black (K), light cyanogen (LC), and a light Magenta (LM).
[0091] At Step S32, a user observes the test pattern printed for every color, and inputs the gap adjustment number of a vertical ruled line pair with least gap into the user interface screen (not shown) of the printer driver of a computer 88 (drawing 2), respectively. Consequently, two adjustment numbers showing the correction value about the light cyanogen nozzle train LC and the light Magenta nozzle train LM, the adjustment number showing the correction value about the black nozzle train K, and ** are stored in P-ROM43 in a printer 20 through a computer 88 (drawing 2). In addition, the input of the above-mentioned gap adjustment number is good also as what is performed from a control panel 32 (drawing 2).
[0092] Correction value about this light cyanogen nozzle train LC and the light Magenta nozzle train LM is made into the foundation at the time of the whole color nozzle train being put in block, and defining the adjustment value of 1 of an amendment sake. On the other hand, the correction value about the black nozzle train K is used only for amendment of the black nozzle train K. Therefore, below, the correction value about the light cyanogen nozzle train LC and the light Magenta nozzle train LM is put in block as "correction value for chromatic colors", and is treated. Corresponding to this, the correction value about the black nozzle train K is called "correction value for colorless." It is the correction value which is not in the relation between the correction value for colorless of these black nozzle trains, the correction value for chromatic colors of the light cyanogen nozzle train LC, the correction value for chromatic colors of the light Magenta nozzle train LM, ** and criteria correction value, and relative correction value, but has the equal relation in which each can perform amendment optimal about each nozzle train. In

addition, "the correction value for colorless" here is the "1st correction value" said to a claim, and "the correction value for chromatic colors" is the "2nd correction value" said to a claim.
[0093] Then, if execution of printing is directed by the user in Step S33, bidirectional printing will be performed in Step S34, performing gap amendment using correction value. Drawing 25 is the block diagram showing the main composition relevant to the gap amendment at the time of bidirectional printing in the 3rd example. Adjustment number storing field 202 a-c corresponding to black, light cyanogen, and a light Magenta and the correction value table 206 are formed in P-ROM43 in a printer 20, respectively. The gap adjustment number which shows the desirable criteria correction value about black, light cyanogen, and a light Magenta, respectively is stored in adjustment number storing field 202 a-c. The correction value table 206 is a table which shifted from the amount of gaps of the record position of the vertical ruled line of the return trip in a test pattern (namely, correction value), and stored the relation with an adjustment number.
[0094] The computer program which has a function as a position gap amendment statement part (record justification section) 210 of an amendment sake is stored in RAM44 in a printer 20 in the position gap at the time of bidirectional printing. The position gap amendment statement part 210 supplies the signal for directing the record timing of a head to the head drive circuit 52 according to the adjustment value based on the correction value for colorless of black, and light cyanogen and the correction value for chromatic colors of a light Magenta. Other points are the same as the 1st example.
[0095] Drawing 26 is a flow chart which shows the procedure of the processing at the time of determining the adjustment value used for amendment of the position gap at the time of bidirectional printing. When the purport which is monochrome printing is notified from a computer 88 (drawing 1), the position gap amendment statement part 210 (drawing 25) substitutes the correction value for colorless for an adjustment value, and supplies the signal for directing the record timing of a head to the head drive circuit 52. On the other hand, when the purport which is color printing is notified from a computer 88 (drawing 1), "the average of the correction value for chromatic colors about light cyanogen (LC) and a light Magenta (LM)" is substituted for an adjustment value, and the signal for directing the record timing of a head is supplied to the head drive circuit 52.
[0096] (2) The effect of the 3rd example : in this example, the correction value for chromatic colors of an amendment sake is determined by the outward trip and return trip of horizontal scanning based on the test pattern actually printed on print media, respectively in record position gap of each color nozzle. For this reason, correction value can be exactly determined so that actual printing gap may decrease.
[0097] Moreover, in color printing, it amends using the light cyanogen in a color nozzle train, and the average of the correction value for chromatic colors of a light Magenta, and is amending in monochrome printing using the correction value for colorless about a black nozzle train. For this reason, amendment optimal about each print mode can be performed.
[0098] Moreover, in the 3rd example, in case the adjustment value for color printing is defined, it is based on the light cyanogen nozzle group and the light Magenta nozzle group. It is the color used in printing of halftone, and, as for light cyanogen and a light Magenta, position gap of a dot has big influence on quality of image in halftone. [many] Therefore, quality of halftone can be made high if correction value is set to the 3rd example in color printing like on the basis of a light cyanogen nozzle group and a light Magenta nozzle group.
[0099] (3) The 1st modification of the 3rd example : drawing 27 is the block diagram showing the main composition relevant to the gap amendment at the time of bidirectional printing in the 1st modification of the 3rd example. The difference from composition of having been shown in drawing 25 is the point that the head drive circuits 52a, 52b, and 52c for driving three actuator chips 91, 92, and 93 are formed independently. That is, three head drive circuits 52a, 52b, and 52c drive three actuator chips 91, 92, and 93 independently. Therefore, position gap amendment at the time of bidirectional printing can be performed for every actuator chip like the case of the 2nd example.
[0100] (4) The 2nd modification of the 3rd example : drawing 28 is state **** explanatory drawing which printed the test pattern for correction value determination in the 2nd modification

of the 3rd example. Although [the 3rd example] each test pattern of light cyanogen and a light Magenta is printed in an outward trip and a return trip and correction value is calculated, respectively, it is good also as defining the correction value which prints one test pattern with light cyanogen and a light Magenta, and expresses the average of the optimal correction value for each based on it. That is, as shown in drawing 28 , in an outward trip, a vertical ruled line is formed in light cyanogen ink, and a vertical ruled line is formed in light Magenta ink in a return trip. Or in an outward trip, a vertical ruled line may be formed in light Magenta ink, and a vertical ruled line may be formed in light cyanogen ink in a return trip. And it is good also as acquiring the adjustment value which is the average of correction value based on the degree of coincidence of the vertical ruled line of the light cyanogen which made such and was formed, and a light Magenta. When the relative physical relationship of "the impact position of actual light cyanogen" and "the impact position of an actual light Magenta" at the time of aiming at the same point on a print sheet in the ink drop of light cyanogen and a light Magenta is fixed, the correction value of the optimal average of correction value for each ink drop can be defined from a test pattern such by printing the ruled line of light cyanogen and a light Magenta in an outward trip and a return trip, respectively.

[0101] In addition, this relation is not restricted to light cyanogen and a light Magenta. Namely, the first pattern of checking printed on print media by one side of the outward trip of horizontal scanning, and a return trip using one kind of ink drop of two or more kinds of ink drops, The second pattern of checking printed on print media on another side of the outward trip of horizontal scanning, and a return trip using the ink drop of other kinds of two or more kinds of ink drops, According to the amendment information which shows the desirable amendment state chosen from ****** position gap checking patterns, the average of the optimal correction value for each of both can be set to the whole correction value at determining correction value, then this appearance.

[0102] (5) The 3rd modification of the 3rd example : in the 3rd example, the test pattern was printed about each (it takes into consideration in the case of amendment) color, respectively absolute correction value was calculated, and the correction value used based on them at the time of color printing was defined. Therefore, when a situation changes, and you like, a user can print a test pattern about each color, and can decide on the 1st correction value and 2nd correction value again. However, it may be troublesome that some users print the test pattern of each color for whenever [the / every]. Therefore, if a test pattern is printed only about black and it decides on correction value again like an example 1, about other colors, it is desirable to enable it to interlock in accordance with the amendment value change of black.

[0103] Drawing 29 is the block diagram showing the main composition relevant to the gap amendment at the time of bidirectional printing in the 3rd modification of the 3rd example. The difference from composition of having been shown in drawing 25 is the point equipped with the adjustment changed-number section 208 of changing the adjustment number of the adjustment number storing fields 202b and 202c with change of the adjustment number of adjustment number storing field 202a. Other points are the same as the 3rd example. In addition, specifically, as for this adjustment changed-number section 208, CPU41 and RAM44 (drawing 2) are equivalent to this.

[0104] In this composition, a user prints a test pattern only about black and decides on the adjustment number of black again, and when the purport which does not print a test pattern about the new adjustment number about the black, and a color besides "" is inputted through a computer 88 or a control panel 32, the adjustment changed-number section 208 performs the following processings. That is, the adjustment changed-number section 208 memorizes the adjustment number about each color before change beforehand. And if the new adjustment number about black is passed from adjustment number storing field 202a, the difference of the adjustment number of the black in change order will be searched for. This difference is minus when the adjustment number is small. And the difference is added to the adjustment number of other colors, and the new adjustment number of other colors is calculated. Then, the new adjustment number is stored in the adjustment number storing fields 202b and 202c of each color. In addition, RAM44 specifically memorizes the adjustment number about each color before

change, the difference of the adjustment number of the black in change order is searched for, and CPU41 specifically calculates the new adjustment number of other colors based on the difference.

[0105] If it does in this way, a user can only print a test pattern only about black, and can get the new adjustment number corresponding to change of a situation about each color. That is, in this modification, a user prints a test pattern about each color, can also define the optimal adjustment number for each, and can print a test pattern only about black, and can also adjust easily about other colors using the adjustment changed-number section 208.

[0106] (6) Others : in the 3rd example, in color printing, although amended by making light cyanogen and a light Magenta into an object color using the average of the correction value for chromatic colors of the light cyanogen nozzle train LC and the light Magenta nozzle train LM, the nozzle train taken into consideration is not restricted to this combination. That is, when using a black nozzle in color printing, you may use the average of the correction value for chromatic colors of the light cyanogen nozzle train LC and the light Magenta nozzle train LM, and the correction value for colorless about a black nozzle train. Furthermore, in addition to the above-mentioned nozzle train, it is good also as an object of consideration of the yellow nozzle train Y, the dark cyanogen nozzle train C, and the dark Magenta nozzle train M.

[0107] Moreover, for example, as shown in drawing 20 , when the composition of the print head is what is equipped with 3 sets of nozzle trains K1-K3 of black (K), and 1 set of cyanogen (C), a Magenta (M) and the nozzle train of yellow (Y), respectively, the average of the correction value for chromatic colors of the cyano nozzle train C and the Magenta nozzle train M shall be used, and amendment at the time of color printing shall be performed. And when using a black nozzle in color printing, the point which may use the average of the correction value for chromatic colors of the cyano nozzle train C and the Magenta nozzle train M and the correction value for colorless about a black nozzle train is the same as that of the above. That is, what thing may be used as long as it determines that gap of the record position of the main scanning direction in the predetermined outward trip and predetermined return trip of an ink drop of an object color is reduced.

[0108] And although the adjustment value which is the average of correction value was made into the average with the simple correction value of each nozzle train (mean value), it is good also as a weighted average of correction value. That is, in consideration of the operating frequency of the color ink of yellow, light cyanogen, a light Magenta, dark cyanogen, and a dark Magenta, and black ink, the ease of being conspicuous of the distance from the center of a nozzle train, and record position gap, etc., weighting is made each correction value for chromatic colors and correction value for colorless, and it asks for an average, and is good also considering this as an adjustment value. Moreover, it can also consider as the geometrical mean. Namely, amendment of record position gap is not based on how the 1st and the correction value for chromatic colors are used, but should just be an amendment thing at least about the gap of a record position which met the main scanning direction at the time of bidirectional printing based on the correction value for chromatic colors.

[0109] Moreover, as a test pattern, it is also possible by the vertical ruled line to use other patterns, such as a straight-line-like pattern with which there is nothing and the dot was recorded intermittently. Namely, what is necessary is just the position gap checking pattern which can choose the amendment information which shows a desirable amendment state, and can determine correction value. It becomes possible to form a test pattern by horizontal scanning once also about the nozzle which cannot form the dot which continues a test pattern in the pattern, then the direction of vertical scanning of the shape of a straight line on which the dot was recorded intermittently, without performing vertical scanning.

[0110] Furthermore, in the 3rd example, although the nozzle group which carries out the regurgitation of the ink of a single color shall be a nozzle train which consists of a nozzle located in a line with the seriate, arrangement of a nozzle is not restricted to this. That is, what thing may be used as long as it is a set of the nozzle which carries out the regurgitation of the ink of a single color.

[0111] And about the test pattern printed in an outward trip and a return trip, respectively, a

ruled line at equal intervals is formed on an outward trip, and in a return trip, from the ruled line of an outward trip, only, although the shifted ruled line shall be formed, it is not restricted to the mode every. Namely, the test pattern which determines the correction value used for monochrome printing should just be a position gap checking pattern for colorless containing the outward trip pattern for colorless formed on the outward trip of horizontal scanning, and the return trip pattern for colorless formed in the return trip of horizontal scanning. And the test pattern used for color printing should just be a position gap checking pattern for chromatic colors containing the outward trip pattern for chromatic colors which is formed of a color nozzle group and formed on the outward trip of horizontal scanning, and the return trip pattern for chromatic colors formed in the return trip of horizontal scanning.

[0112] F. Other modifications : in addition, this invention can be carried out in various modes in the range which is not restricted to an above-mentioned example or an above-mentioned operation gestalt, and does not deviate from the summary, for example, the following deformation is also possible for it.

[0113] F1. modification 1: Like the 1st example and the 2nd example, it is desirable to set up the relative correction value concerning a nozzle train in the position gap at the time of bidirectional printing for every horizontal-scanning speed in the printer of the type which can use two or more values as a horizontal-scanning speed (traverse speed of carriage) in the amendment case using criteria correction value and relative correction value. Moreover, it is desirable to set up the correction value about each nozzle train for every horizontal-scanning speed by the printer which can use two or more values as a horizontal-scanning speed also about the case where correction value absolute about each nozzle train is set up, like the 3rd example. This is based on the following reasons. That is, if the horizontal-scanning speed Vs differs so that the explanation of drawing 9 mentioned above may show, the relative amount of position gaps of nozzle trains will also change. Therefore, if correction value is set up for every different horizontal-scanning speed, it is possible to reduce more the position gap at the time of bidirectional printing.

[0114] F2. modification 2: It is desirable to set up relative correction value for the dot of the size from which plurality differs the position gap at the time of bidirectional printing in the same ink using criteria correction value and relative correction value in the amendment case for every size of a dot like the 1st example and the 2nd example in the multiple-value printer of the type which can be formed in each pixel position. Moreover, it is desirable like the 3rd example to set up correction value for every size of a dot by the multiple-value printer which can form the dot of the size from which plurality differs in the same ink also about the case where correction value absolute about each nozzle train is set up. This is based on the following reasons. That is, if dot sizes differ, the **** speed of an ink drop will also change. Therefore, if correction value is set up for every different dot size, it is possible to reduce more the position gap at the time of bidirectional printing. In addition, by the multiple-value printer, only the dot of the same size may be unable to be formed by one nozzle train between one horizontal scanning. In this case, since the size of a dot is chosen for every horizontal scanning, the suitable value [correction value / which is used for amendment of position gap] according to dot size the whole horizontal scanning is chosen.

[0115] In addition, it is possible that ****** operation which breathes out the dot from which size differs is a print mode from which ink **** speed differs mutually. Therefore, the modification mentioned above means setting up correction value about each in two or more dot **** modes in which ink **** speed differs mutually, respectively.

[0116] F3. modification 3: Although relative correction value was set up in the 2nd example for every actuator chip which drives the nozzle train of two trains, respectively, it is still more desirable to set up relative correction value independently for every nozzle trains other than a criteria nozzle train. And it is desirable similarly to set up the correction value for chromatic colors independently for every nozzle train of a color nozzle group also in the 3rd example. If it carries out like this, it is more possible than each example mentioned above to reduce position gap further. Moreover, you may make it set up relative correction value independently for every group of the ** nozzle train which breathes out the same ink. For example, when the ** nozzle

train which breathes out specific ink is established 2 sets, you may make it apply the same relative correction value to 2 sets of the nozzles.

[0117] F4. modification 4: Although the black nozzle train was chosen in the 1st or 2nd example as a criteria nozzle train at the time of determining criteria correction value and relative correction value, it is possible to choose arbitrary nozzle trains other than a black nozzle train as a criteria nozzle train. However, since it is hard to recognize a test pattern in case a user determines criteria correction value in the low ink (light cyanogen and light Magenta) of concentration, it is desirable to use the nozzle train which carries out the regurgitation of the comparatively high ink (black, dark cyanogen, dark Magenta) of concentration as a criteria nozzle train.

[0118] F5. modification 5: Although position gap was amended by adjusting the record position (or record timing) of a dot in the 1st or 3rd example, you may be made to amend position gap using meanses other than this. For example, it is also possible by delaying the driving signal to an actuator chip, or adjusting the frequency of a driving signal for it to be made to amend position gap.

[0119] F6. modification 6: Although position gap was amended by adjusting the record position (or record timing) of a return trip in each above-mentioned example, it is good as for a method of an amendment in position gap by adjusting the record position of an outward trip. Moreover, it is good as for a method of an amendment in position gap by adjusting both record positions of an outward trip and a return trip. namely, the thing for which at least one side of the record position of an outward trip and a return trip is generally adjusted -- position gap -- an amendment -- what is necessary is just to make it like

[0120] F7. modification 7: In each above-mentioned example, although the ink jet printer was explained, this invention is applicable to the printer not only an ink jet printer but various which generally prints using the print head. Moreover, this invention is applicable not only to the method of carrying out the regurgitation of the ink drop, or equipment but the method and equipment which record a dot with other meanses.

[0121] F8. modification 8: You may make it transpose a part of composition of that hardware was realized to software, and may make it transpose a part of composition of that software realized to hardware conversely in each above-mentioned example. For example, it is also possible to realize with software the function of a part of head drive circuit 52 shown in drawing 12 .

[Translation done.]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] The outline block diagram of the printing system equipped with the printer 20 of the 1st example.
[Drawing 2] The block diagram showing the composition of the control circuit 40 in a printer 20.
[Drawing 3] The perspective diagram showing the composition of the print head unit 60.
[Drawing 4] Explanatory drawing showing the composition for the ink regurgitation in each print head.
[Drawing 5] Explanatory drawing showing signs that the ink particle Ip is breathed out by extension of piezo-electric element PE.
[Drawing 6] Explanatory drawing showing the correspondence relation between the nozzle of two or more trains in the print head 28, and two or more actuator chips.
[Drawing 7] The decomposition perspective diagram of the actuator circuit 90.
[Drawing 8] The fragmentary sectional view of the actuator circuit 90.
[Drawing 9] Explanatory drawing showing the position gap at the time of bidirectional printing of the dot recorded in a different nozzle train.
[Drawing 10] Explanatory drawing showing superficially the position gap shown in drawing 9 .
[Drawing 11] The flow chart which shows the whole processing of the 1st example.
[Drawing 12] The flow chart which shows the detailed procedure of Step S2 of drawing 11 .
[Drawing 13] Explanatory drawing showing an example of the test pattern for relative correction value determination.
[Drawing 14] Explanatory drawing showing the relation between the relative correction value delta and Head ID.
[Drawing 15] The flow chart which shows the detailed procedure of step S4 of drawing 11 .
[Drawing 16] Explanatory drawing showing an example of the test pattern for criteria correction value determination.
[Drawing 17] The block diagram showing the main composition relevant to the gap amendment at the time of bidirectional printing in the 1st example.
[Drawing 18] Explanatory drawing showing the content of the position gap amendment using the criteria correction value and relative correction value when choosing a black dot and a cyano dot as an object dot.
[Drawing 19] Explanatory drawing showing the content of the position gap amendment using the criteria correction value and relative correction value when choosing only a cyano dot as an object dot.
[Drawing 20] Explanatory drawing showing other composition of print head 28a.
[Drawing 21] The block diagram showing the composition of control circuit 40a used in the 2nd example.
[Drawing 22] The flow chart which shows the procedure of the processing at the time of determining the adjustment value used for amendment of the position gap at the time of bidirectional printing in the 1st example.
[Drawing 23] The flow chart which shows the procedure which prints by defining an adjustment value based on a test pattern.

[Drawing 24] State **** explanatory drawing which printed the test pattern for correction value determination in the 3rd example.
[Drawing 25] The block diagram showing the main composition relevant to the gap amendment at the time of bidirectional printing in the 3rd example.
[Drawing 26] The flow chart which shows the procedure of the processing at the time of determining the adjustment value used for amendment of the position gap at the time of bidirectional printing in the 3rd example.
[Drawing 27] The block diagram showing the main composition relevant to the gap amendment at the time of bidirectional printing in the 1st modification of the 3rd example.
[Drawing 28] State **** explanatory drawing which printed the test pattern for correction value determination in the 2nd modification of the 3rd example.
[Drawing 29] The block diagram showing the main composition relevant to the gap amendment at the time of bidirectional printing in the 3rd modification of the 3rd example.
[Description of Notations]
20 -- Ink jet printer
22 -- Ejection motor
24 -- Carriage motor
26 -- Platen
28 -- Print head
30 -- Carriage
31 -- Dashboard
32 -- Control panel
34 -- Sliding shaft
36 -- Driving belt
38 -- Pulley
39 -- Position sensor
40 -- Control circuit
41 -- CPU
43 -- PROM
44 -- RAM
50 -- I/F personal circuit
52 -- Head drive circuit
54 -- Motorised circuit
56 -- Connector
60 -- Print head unit
71-76 -- Introductory pipe
80 -- Ink path
88 -- Computer
90 -- Actuator circuit
91-93 -- Actuator chip
100 -- Head ID seal
110 -- Nozzle plate
112 -- Reservoir plate
120 -- End-connection child plate
122 -- Internal connection terminal
124 -- External end-connection child
130 -- Ceramic sintered compact
132 -- Terminal electrode
200 -- Head ID storing field
202,202 a-c -- Adjustment number storing field
204 -- Relative correction value table
206 -- Criteria correction value table
208 -- Adjustment changed-number section
210 -- Position gap amendment statement part (adjustment value determination section)

[Translation done.]